Mid Term Paper (Summer- 2020)

Basic Electronics

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Semester: 7th **Date: 20 August, 2020**
Time: 5 hours **Total Marks: 30**
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Q1:

a. Explain how the transformer turns ratio affects the rectified output voltage of full wave rectifier?

Answer

If the transformers turns ratio is 1 the peak value of the rectified output voltage equals half the peak value of the primary input voltage less the barrier potential. This is because half of the primary voltage appears across each half of the secondary winding V, equal to the input peak a step up transformer with a turns ratio of n = 2 must be used. In this case the total secondary voltage is twice the primary voltage so the voltage across each half of the secondary is equal to Vpri. In any case the output voltage of center tapped full wave rectifier is always on half of the total secondary voltage less the drop no matter what the turns ratio

Vout = (Vso/2) - 0.7V %3D sec

b. Compare the center-tapped rectifier and the bridge rectifier?

Center Tapped Full Wave Rectifier

In the center tapped full wave rectifier two diodes were used.
These are connected to the center tapped secondary winding of the transformer.
The positive terminal of two diodes is connected to the two ends of the transformer.
Center tap divides the total secondary voltage into equal parts.
The centre-tap is usually considered as the ground point or the zero voltage reference point

Full Wave Bridge Rectifier

Full wave bridge rectifier four diodes are arranged in the form of a bridge.
This configuration provides same polarity output with either polarity.
The main advantage of this bridge circuit is that it does not require a special centre tapped transformer.
The single secondary winding is connected to one side of the diode bridge network and the load to the other side

c. List the advantages and disadvantages of the RC filter and LC filter?

RC Filter

Advantages of RC filters :

- Reduced size and weight '
- increased reliability and improved performance
- simpler design than for passive filters and can realize a wider range of functions as well as providing voltage gain
- In large quantities, the cost of an IC is less than its passive counterpart

Disadvantages:

- limited bandwidth of active devices limits the highest attainable frequency (passive RLC filters can be used to 500 MHz)
- Require power supplies (unlike passive filters)
- Increased sensitivity to variations in circuit parameters caused by environmental changes compared to passive filters
- For many applications, particularly in voice and data communications, the economic and performance advantages of active RC filters far outweigh their disadvantages.

LC Filter :

Advantages

- The choke input (LC) filter has a high output D.C voltage.
- It has no loading effect on the rectifier and power transformer.
- The diode does not have to carry surge currents.
- It has a very low ripple factor as compared to series inductor filter and shunt capacitor filter. It has very good load regulation.
- It has no loading effect on the rectifier and power transformer.
- It has better voltage regulation than that of π filter.

Disadvantages

- It cannot be used together with half wave rectifier.
- Due to inductor it produces the audible noise.
- It is not useful for very low load currents.
- There is a loss of power in the series inductor due to its DC resistance.
- It has low output D.C. voltage than that of π type filter.
- It has high ripple factor than that of π type filter.
- It becomes costly due to the use of large value of an inductor L and a capacitor C.
- The use of bleeder resistor increases the rating of rectifier circuit.

Q2:

a. What would be an advantage of a 50 Ω voltage source compared to a 600 Ω voltage source?

Answer:

For the 50 Ohm voltage source, maximum power transfer will occur when the load has a appears as a resistance of 50 Ohms. Similarly, 600 Ohms is required for max power transfer into an impedance that presents itself as 600 Ohms. You need to maintain the integrity of the impedance at all points if you are to avoid reflections down the line and damaging the output PA. So, if you had an antenna rated at 50 Ohms connected to a 50 Ohm feed then all things being equal min SWR etc you be better with 50 Ohms source. Some configurations of antenna may be "seen" as presenting an impedance of say 580 Ohms in which case the 600 ohm may be the closest and best alternative. However, the loads need not be in radio engineering. So the choice between the two depends on what the impedance of the load you are trying to drive. However, these days Baluns can sometimes be used.

b. Which approximation does the technician normally use when performing initial troubleshooting procedures? Why?

Answer :

c. What are some of the reasons for using a Thevenin or Norton circuit?

Answer:

Thevenin and Norton equivalent circuits are fundamental approaches to analyzing both AC and DC circuits. It is important to understand the steps involved in converting a circuit to its Thevenin or Norton equivalent, but more important still is understanding how these techniques can help you to analyze and design actual electronic devices.

Thevenin's theorem states that any circuit composed of linear elements can be simplified to a single voltage source and a single series resistance (or series impedance for AC analysis).

Norton's theorem is the same except that the voltage source and series resistance are replaced by a current source and parallel resistance.

As with Thevenin's Theorem, everything in the original circuit except the load resistance has been reduced to an equivalent circuit that is simpler to analyze. Also similar to Thevenin's Theorem are the steps used in Norton's Theorem to calculate the Norton source current (INorton) and Norton resistance (RNorton).

Norton's Theorem is a way to reduce a network to an equivalent circuit composed of a single current source, parallel resistance, and parallel load.

Steps to follow for Norton's Theorem:

Find the Norton source current by removing the load resistor from the original circuit and calculating the current through a short (wire) jumping across the open connection points where the load resistor used to be.

Find the Norton resistance by removing all power sources in the original circuit (voltage sources shorted and current sources open) and calculating total resistance between the open connection points.

Draw the Norton equivalent circuit, with the Norton current source in parallel with the Norton resistance. The load resistor re-attaches between the two open points of the equivalent circuit.

Analyze voltage and current for the load resistor following the rules for parallel circuits.

The advantage in performing the "Thevenin conversion" to the simpler circuit, of course, is that it makes load voltage and load current so much easier to solve than in the original network.

Thevenin's Theorem is a way to reduce a network to an equivalent circuit composed of a single voltage source, series resistance, and series load.

Steps to follow for Thevenin's Theorem:

Find the Thevenin source voltage by removing the load resistor from the original circuit and calculating the voltage across the open connection points where the load resistor used to be.

Find the Thevenin resistance by removing all power sources in the original circuit (voltage sources shorted and current sources open) and calculating total resistance between the open connection points.

Draw the Thevenin equivalent circuit, with the Thevenin voltage source in series with the Thevenin resistance. The load resistor re-attaches between the two open points of the equivalent circuit.

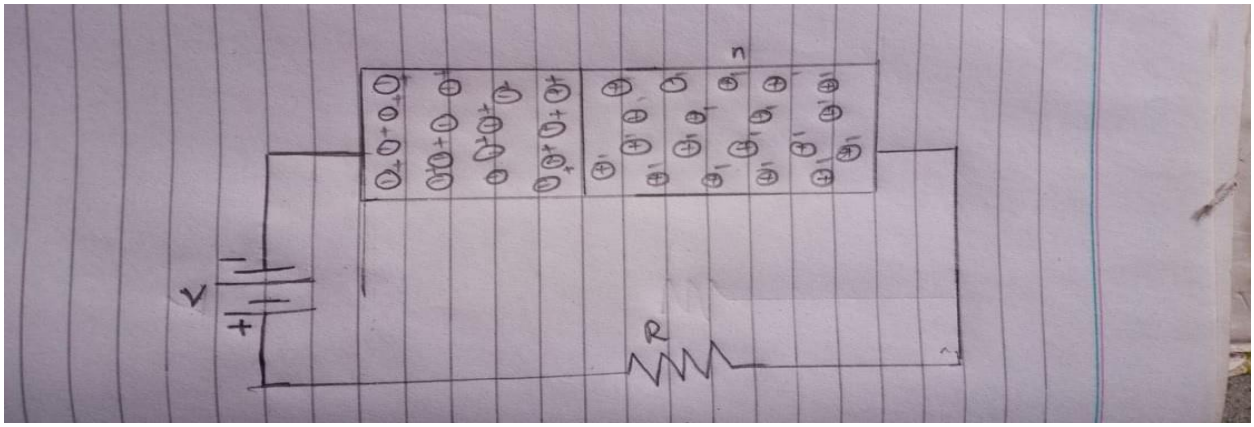
Analyze voltage and current for the load resistor following the rules for series circuits.

Q3:

a. **Tell me why a very small current exists in a reverse-biased diode?**

Answer

When the negative battery terminal is connected to p side and the positive battery terminal is connected to n side. This connection produces reverse bias across the diode. The following is the circuit diagram of diode in reverse bias:



b. **I want to know why a light emitting diode produces light. Tell me about it.**

Answer

A light-emitting diode (LED) is a semiconductor light source that emits light when current flgws through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons.

c. Do holes flow in a conductor? Why or why not? What happens to holes when they reach the end of a semiconductor?

Answer :

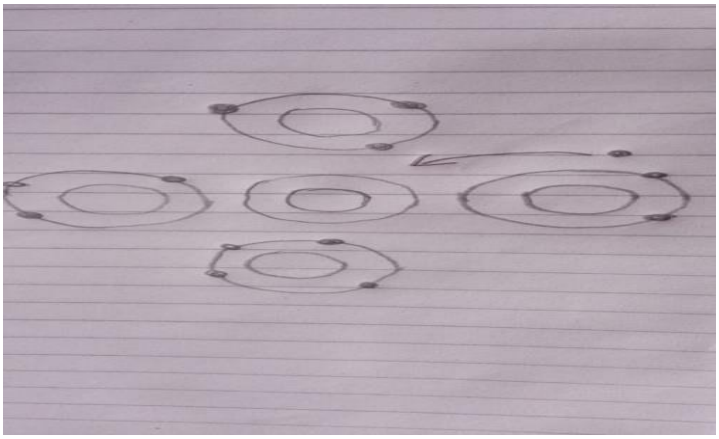
Name semiconductor "Mark fox"

Holes do exist in conductors. It's only that it's very difficult to identify them as the conduction and valance bands overlap. It should be discernible as a function of temperature or magnetic field. Electron is said to be free in the conduction band. If only the external stress (optical) electron will stay for a time dependent on material characteristics and come back to lower energy state. you can find more answer about your interest in the book of optical properties of semiconductor "Mark fox"

d. Why is recombination important in a diode?

In a pure silicon crystal, the thermal energy creates an equal number of free electrons and holes. The free electrons move randomly throughout the crystal. Occasionally, a free- electron will approach a hole, feel its attraction and fall into it. This is known as recombination. Because of this recombination energy is released.

The Following is the Figure showing the recombination of a free electron and a hole:



e. What is surface leakage current?

Answer :

Definition of surface leakage current

Diode reverse current that passes along the surface of the semiconductor materials.